



Multipolar materials for lithium batteries

SiO_x is a highly promising anode material for realizing high-capacity lithium-ion batteries owing to its high theoretical capacity. However, the large volume change during cycling limits its practical application. The development of a binder has been demonstrated as one of the most economical and efficient strategies for enhancing the SiO_x anode's electrochemical ...

Key techniques and materials for enabling BEs are highlighted and an outlook for the future directions of BEs that involve emerging concepts, such as wearable devices, all-solid-state batteries, fast spraying fabrication, ...

Layered lithium nickel-rich oxides, Li[Ni_{1-x}M_x]O₂ (M=metal), have attracted significant interest as the cathode material for rechargeable lithium batteries owing to...

Abstract In this study, ZnSnO₃/C nanofibers are successfully prepared using a simple electrospinning method and their morphology and electrical properties are characterized. The results show that the diameter of the ZnSnO₃/C nanofibers is ~190 nm and they comprise ~25 nm particles. The lithium-ion battery (LIB) fabricated using the prepared ZnSnO₃/C ...

To reach the modern demand of high efficiency energy sources for electric vehicles and electronic devices, it is become desirable and challenging to develop advance lithium ion batteries (LIBs) with high energy capacity, power density, and structural stability. Among various parts of LIBs, cathode material is heaviest component which account almost 41% of ...

This article reviews the development of cathode materials for secondary lithium ion batteries since its inception with the introduction of lithium cobalt oxide in early 1980s. The time has passed ...

Lithium secondary batteries have been the most successful energy storage devices for nearly 30 years. Until now, graphite was the most mainstream anode material for lithium secondary batteries. However, the lithium storage mechanism of the graphite anode limits the further improvement of the specific capacity. The lithium metal anode, with the lowest ...

“Recycling a lithium-ion battery consumes more energy and resources than producing a new battery, explaining why only a small amount of lithium-ion batteries are recycled,” says Aqsa Nazir, a ...

Li-Ion technology is based on the reversible intercalation of lithium ions into host materials at the positive and negative electrodes. Even if the first Li-Ion cells were commercialized in 1991 by Sony, the first work exhibiting the reversible intercalation of lithium into Li_xTiS₂ positive electrode was reported by Whittingham et al. for Exxon in 1976 [].

Due to a high energy density and satisfactory longevity, lithium-ion batteries (LIBs) have been widely applied in the fields of consumer electronics and electric vehicles. Cathodes, an essential part of LIBs, greatly



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determine the energy density and total cost of LIBs. In order to make LIBs more competitive, it is urgent to develop low-cost commercial cathode ...

Lin, F. et al. Surface reconstruction and chemical evolution of stoichiometric layered cathode materials for lithium-ion batteries. *Nat. Commun.* 5, 3529 (2014).

Lithium-manganese-oxides have been exploited as promising cathode materials for many years due to their environmental friendliness, resource abundance and low biotoxicity. Nevertheless, inevitable problems, such as Jahn-Teller distortion, manganese dissolution and phase transition, still frustrate researchers; thus, progress in full manganese-based cathode ...

1 Introduction. Lithium-ion batteries (LIBs) play the dominant role in the market of portable electronics devices and have gradually extended to large-scale applications, such as electric vehicles (EVs) and smart grids. [] With the rapid development of EVs, superior performance is required for LIBs, especially with high energy density, high power density, and low cost. []

Polyimides (PIs) as coatings, separators, binders, solid-state electrolytes, and active storage materials help toward safe, high-performance, and long-life lithium-ion batteries (LIBs). Strategies to design and utilize PI ...

The active material is one that actually takes lithium ions in and out in battery operation. Typical cathode materials for Li ion batteries include LiCoO_2 , LiFePO_4 , $\text{LiNi}_x\text{Mn}_y\text{Co}_{(1-x-y)}\text{O}_2$, and $\text{LiNi}_x\text{Al}_y\text{Co}_{(1-x-y)}\text{O}_2$, where x and y vary depending on applications and cell manufacturers [1, 2].

Lithium-sulfur batteries (LSBs) are considered to be one of the most promising candidates for becoming the post-lithium-ion battery technology, which would require a high level of energy density across a variety of applications. An increasing amount of research has been conducted on LSBs over the past decade to develop fundamental understanding, modelling, ...

Abstract Silicon (Si) is a representative anode material for next-generation lithium-ion batteries due to properties such as a high theoretical capacity, suitable working voltage, and high natural abundance. However, due ...

This paper reviews the recent developments of cellulose materials for lithium-ion battery separators. The contents are organized according to the preparation methods such as coating, casting, electrospinning, phase inversion and papermaking. The focus is on the properties of cellulose materials, research approaches, and the outlook of the applications of ...

In order to achieve the long range and low cost of LIBs, high-nickel multifunctional cathode materials are one of the most promising cathode materials for large-scale ...

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Materials Science, Engineering, Chemistry; View via Publisher. Save to Library Save. ... we build a tunable multipolar conjugated polymer framework platform via pore wall chemistry to probe the role of electronic structure engineering in improving the ... All-solid-state lithium-metal batteries are at the forefront of battery research and ...

Here, we build a tunable multipolar conjugated polymer framework platform via pore wall chemistry to probe the role of electronic structure engineering in improving the Li⁺ conduction by theoretical studies. Guided by theoretical prediction, we develop a new cyano-vinylene-linked multipolar polymer framework namely CNF-COF, acting as efficient ion sieves to modify ...

The layered oxide cathode materials for lithium-ion batteries (LIBs) are essential to realize their high energy density and competitive position in the energy storage market. ...

Lithium-ion batteries (LIBs) have been widely used in electric vehicles, portable devices, grid energy storage, etc., especially during the past decades because of their high specific energy densities and stable cycling performance (1-8). Since ...

With the rapid development of various portable electronic devices, lithium ion battery electrode materials with high energy and power density, long cycle life and low cost were pursued. Vanadium-based oxides/sulfides were considered as the ideal next-generation electrode materials due to their high capacity, abundant reserves and low cost. However, the inherent ...

Fig. 2 a depicts the recent research and development of LIBs by employing various cathode materials towards their electrochemical performances in terms of voltage and capacity. Most of the promising cathode materials which used for the development of advanced LIBs, illustrated in Fig. 2 a can be classified into four groups, namely, Li-based layered ...

Based on the energy-storage mechanism of cathode materials during fast-charging, a series of strategies, including nanostructure, doping and multiple-system, are discussed, while emphasis on the pseudocapacitive contribution in the battery type cathode materials for constructing the fast-charging lithium-ion batteries and sodium-ion batteries.

With a focus on next-generation lithium ion and lithium metal batteries, we briefly review challenges and opportunities in scaling up lithium-based battery materials and ...

Nickel for better batteries: This Review systematically summarizes Ni-rich layered materials as cathodes for lithium-ion batteries through six aspects: synthesis, mechanism, element doping, surface coating, compositional partitioning, and electrolyte adjustment with the aim to boost the development and achieve



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expectations.

High-entropy materials have also been investigated for their potential as separators in lithium-sulfur (Li-S) batteries. Lithium-sulfur batteries are of particular interest due to their cost-effectiveness, sulfur abundance, high theoretical capacity (1675 mAh g⁻¹), and high energy density (2600 Wh kg⁻¹), making them promising ...

it is still an essential material in the production of most Li-ion battery cathodes. Since graphite is the primary material used as anode material in current Li-ion batteries, natural graphite is also essential in the current Li-ion battery industry. Of course, there is no Li-ion battery without lithium. While metallic lithium is only present ...

The basic components of lithium batteries. Anode Material. The anode, a fundamental element within lithium batteries, plays a pivotal role in the cyclic storage and release of lithium ions, a process vital during the charge and discharge phases. Often constructed from graphite or other carbon-based materials, the anode's selection is grounded ...

Lithium fluoride (LiF) at the solid electrolyte interface (SEI) contributes to the stable operation of polymer-based solid-state lithium metal batteries.

In addition, by further analyzing the lithium anode, it can also be seen that significant quantity of detached and permeable "dead lithium" can be detected on the surface of the lithium anode following repeated lithium plating/stripping for Li/PL/Li batteries (Fig. 6 d). In the case of Li/PL-15 % MIL-125/Li cells, a significant quantity of ...

At similar rates, the hysteresis of conversion electrode materials ranges from several hundred mV to 2 V [75], which is fairly similar to that of a Li-O₂ battery [76] but much larger than that of a Li-S battery (200-300 mV) [76] or a traditional intercalation electrode material (several tens mV) [77]. It results in a high level of round-trip ...

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